

EDIBLE FISHES OF QUEENSLAND.

BY J. DOUGLAS OGILBY (ICHTHYOLOGIST).

PART XV.—SERRANIDÆ (No. 1).

(Plates I to III.)

Percalates Ramsay & Ogilby, Proc. Linn. Soc. N. S. Wales, xii, 1887, p. 182; Ogilby, Edib. Fish N. S. Wales, 1893, p. 2; Boulenger, Catal. Percif. Fish., 1895, p. 132. Type—*Lates colonorum* Günther 1863.

Body subovate and compressed. Scales moderate, adherent, concentrically striated, more or less strongly ciliated, those of the throat and breast small. Lateral line complete, continued on the base of the caudal fin, the tube simple and straight, not extending to the border of the scale. Head large and partly naked, the upper profile variable. Mouth terminal and protractile, with wide oblique cleft, the lower jaw more or less projecting, the maxillary large and dilated, exposed, with well developed supramaxillary. Teeth in villiform bands, on the jaws, vomer, and palatines; tongue toothless. Nostrils of moderate size, approximate, opening in front of the middle of the eye, and much nearer to it than to the edge of the preorbital, the anterior valvular. Preorbital, suborbital, and vertical border of preopercle serrated; angle and lower border of preopercle armed with strong teeth, which on the latter may be antrorse; opercle with two divergent spines, the lower much the longer; postclavicle and posttemporal usually serrated. Two dorsal fins, connected at the base, the first with viii, rarely ix, strong pungent spines, the interspinous membrane deeply cleft; second dorsal shorter than the first, with i 8 to 11 rays, the base concealed by a low scaly sheath. Caudal emarginate, with 17 principal rays. Anal short, with iii 7 to 9 rays, extending well beyond and similar to the second dorsal. Pectoral obtusely pointed, with 12 to 16 rays, the upper middle ones the longest. Ventral longer than the pectoral with i 5 rays, inserted a little behind the pectoral-base. Gill-openings wide; gill-membranes separate, free from the isthmus; six branchiostegals; pseudobranchiæ present; gills four, a slit behind the fourth; gill-rakers stout and well developed, in moderate number; pharyngeal bones large, densely covered with small teeth. Air-bladder present, large. Stomach caecal, intestinal canal convoluted, pyloric appendages in moderate number. Posterior processes of the premaxillaries not extending to the frontals; parietal and supraoccipital bones not extending to between the postfrontal processes; supraoccipital crest strong, not produced on the frontals. Vertebrae 11 + 14 = 25.

Monotypic. The single species inhabiting the fresh waters and estuaries of Southern and Eastern Australia, from the Gulf of Saint Vincent, S.A., to the Pine River, S.Q.

Notes:—Boulenger describes and McCoy figures the scales of this fish as being "cycloid." Of the numbers which I have examined I have never seen one to which this description could be correctly applied; the strength of the ciliation is, however, extremely variable, and some specimens only show it weakly along the middle of the side, where about half a dozen small teeth are alone present on the middle of the outer edge of the scale, leaving a broad dorsal and abdominal cycloid band. Normally, however, the scales of the estuarine forms show distinct ciliation, except those of the nape and a narrow, gradually contracting band below the base of the spinous dorsal, where they are constantly cycloid. And this variation in the scale-character of those examples which more or less permanently reside in the brackish water of an estuary, leads naturally on to the much coarser ciliation of the scales of those individuals which have taken on a more or less purely fluviatile existence. This character, therefore, is manifestly of no value as a specific factor. With regard to the emargination of the upper profile of the head, on which Stead lays so much stress, I find that this is wholly caused by the usually more marked convexity of the snout in the estuarine form, which necessarily induces a hollow between the snout and the occipitonuchal convexity. As, however, I have examined several of these fishes in which, through the straightening of the snout-contour, the emargination was practically eliminated, it will be understood that I can not see my way to accepting this character as of specific value, the difference being in my opinion more apparent than real.

PERCALATES COLONORUM (Günther).

- Lates colonorum* Günther, Ann. & Mag. Nat. Hist. (3) xi, 1863, p. 114; Castelnau, Proc. Zool. & Acl. Soc. Vie., i, 1872, p. 43; McCoy, Prodr. Zool. Vic., dec. ii, 1878, pl. xiv; Macleay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 304; Tenison-Woods, Fish & Fisher. N. S. Wales, 1882, p. 31, pl. i; Johnston, Proc. Roy. Soc. Tas., 1882, p. 59; O'Connor, Proc. Roy. Soc. Queensl., xii, 1897, p. 110; Zietz, Trans. Roy. Soc. S. Austr., xxvi, 1902, p. 265.
- Dules novemaculeatus* Steindachner, Sitz. Akad. Wien, liii, 1886, i, p. 428, pl. i, fig. 2; id., ibid., lx, 1869, i, p. 674; Klunzinger, Arch. f. Nat., xxxviii, 1872, i, p. 20.
- Dules reinhardtii* Steindachner, ibid., lvi, 1867, i, p. 320.¹
- Lates similis* Castelnau, ibid., p. 44; Macleay, ibid., p. 305.
- Lates antarcticus* Castelnau, ibid.; Macleay, ibid.
- Lates victoriae* Castelnau, ibid., p. 45; Macleay, ibid.
- Lates curtus* Castelnau, Res. Fish. Austr., 1875, p. 5; Macleay, ibid., p. 306.
- Lates ramsayi* Macleay, ibid.
- Percalates colonorum* Ogilby, Edib. Fish. N. S. Wales, 1893, p. 2, pl. i; Boulenger, Catal. Percif. Fish., 1895, p. 132; Stead, Fish. Austr., 1906, p. 96; id., Edib. Fish. N. S. Wales, 1908, p. 53, pl. xxii, low. fig.; id., Proc. Linn. Soc. N. S. Wales, xxxv, 1910, p. 659; Roughley, Fish. Austr., 1916, p. 60.
- Percalates fluviatilis* Stead, Proc. Linn. Soc. N. S. Wales, xxxi, 1906, p. 261; id., Edib. Fish. N. S. Wales, 1908, p. 54, pl. xxii, upp. fig.; McCulloch, Proc. Linn. Soc. N. S. Wales, xxxv, 1910, p. 432; Stead, Proc. Linn. Soc. N. S. Wales, xxxv, 1910, p. 658.

¹ Boulenger, I believe erroneously, quotes this form as *Dules reinwardti*; I follow Günther (Zool. Rec., iv, 1867, p. 159). McCulloch, in answer to a query, kindly writes—"According to my slip, copied from the original reference, the name is *Dules Reinhardtii*."

BASS.

Australian Bass; Perch; Estuary Perch; Fresh-water Perch.

Type localities:—Victoria (*L. colonorum*),
 Neighborhood of Sydney (*D. novemaculeatus*).
 Port Jackson (*D. reinhardtii*).
 Gippsland Lakes (*L. similis*).
 Melbourne Market (*L. antarcticus*).
 Melbourne Market (*L. victoriæ*).
 Richmond River, N.S.W. (*L. curtus*).
 Waterhole at Parramatta, N.S.W. (*L. ramsayi*).
 Rivers of New South Wales (*P. fluviatilis*).

Dorsal contour of body rather more arched than that of the ventral, its width at the shoulder 1.9 to 2.5 in its depth immediately in front of the ventral fins, which is 2.4 to 3 in its length and equal to or a little more than the length of the head. Caudal peduncle stout, its depth 1.37 to 1.6 in its length behind the soft dorsal and 2.4 to 2.67 in the length of the head. Head from two fifths to four fifths deeper than wide, the upper profile varying from linear in fluviatile examples to emarginate in those which remain permanently in estuarine waters, the difference being solely caused by the shape of the snout, the contour of which is more or less rounded in the latter form, thus making with the occipito-nasal convexity an intervening fictitious emargination; depth of head 1.38 to 1.5 in its length, which is 2.55 to 3.25 in that of the body. Snout pointed, its length 3.75 to 4.17 in that of the head. Diameter of eye from one fourth more to one fifth less than the length of the snout and 3.33 to 4.75 in that of the head; preorbital narrow; interorbital region wide and moderately convex, its width equal to one half less than the eye-diameter. Maxillary extending to below or a little beyond the middle of the eye, its length 2.33 to 2.7 in that of the head, the width of its truncate distal extremity 1.33 to 3 in the eye-diameter. Preorbital and suborbital finely and evenly serrated, the edge of the former undulous or emarginate; hinder limb of preopercle linear and subvertical, armed with fine serræ which gradually decrease in size from below and are absent or vestigial on the upper part of the limb; angle and lower limb with a series of strong, more or less curved spines, which are sometimes broken up distally into two or more points and, on the latter may be arranged in groups, each individual spine having a more or less antrorse direction; lower opercular spine two thirds to three fifths of the eye-diameter.

Premaxillary bands of teeth broader than those of the mandible, each separated by a symphyisial hiatus, and each diminishing to a blunt point behind; vomerine teeth in an arcuate band, of equal width throughout, as also is the palatine band.

Scales of body more strongly ctenoid in the fluviatile than in the estuarine form, arranged in 48 to 55 series above the lateral line, in 7 to 9/1/16 to 19 between the fifth dorsal spine and the vent. Scales of nape, a strip along the base of the spinous dorsal, throat, and head cycloid. Opercles, postorbital, and

parietal regions, and cheeks scaly, the rest of the head naked; cheek-scales much smaller than the others, in 8 or 9 series between the eye and the angle of the preopercle. Lateral line following the curvature of the back.

Dorsal fins with viii or ix, i 8 to 11 rays, originating slightly behind the pectoral-base, and terminating above the fifth or sixth anal ray; first spine short, 4.2 to 4.75 in the longest, which is usually the fourth, though the fifth sometimes slightly exceeds it, and is 1.67 to 2.67 in the length of the head, the last as long as or a little longer than the second, 1.9 to 2.2 in the longest, and 1.22 to 1.4 in the spine of the second dorsal, which is 1.4 to 1.67 in the longest ray; first, second, or third ray longest, one sixth more to one sixth less than the longest spine, and subequal to the basal length of the second dorsal, which is 1.17 to 1.33 in that of the first; first dorsal ray divided distally, the last split to the base; outer border of soft rays gently rounded. Caudal fin emarginate, with 17 principal rays, the lobes equal and obtusely pointed, the middle rays 1.38 to 1.67 in the upper lobe, which is 3.55 to 3.83 in the body-length. Anal fin with iii 7 to 9 rays, originating below the third or fourth dorsal ray; second and third spines equal or the third a little the longest, intermediate in length to the sixth and seventh dorsal spines, 2.44 to 3.67 in the length of the head, and 1.33 to 1.5 in the first or second ray, which is one tenth to one fourth more than the basal length and 1.8 to 2.2 in the length of the head; outer border linear; rays similar to those of the dorsal. Pectoral obtusely pointed, with 12 to 16 rays, its length 1.55 to 2 in that of the head; fourth or fifth ray longest, extending to below the sixth or seventh dorsal spine. Ventral bluntly pointed, the spine strong and pungent, 1.37 to 1.67 in the length of the first and second rays, which are subequal, 1.44 to 1.7 in the length of the head, and do not usually reach the vent.

Gill-openings extending forward to below the middle of the eye; gill-rakers longer than the gill-fringes, 13 to 16 on the lower branch of the anterior arch, the longest 1.3 to 2.67 in the eye-diameter; pyloric appendages 10.

Upper surface varying from olive-brown to deep olive-green, the head darkest; sides and lower surfaces shading from grayish green to grayish white, the latter and the cheeks sometimes washed with yellow. All the fins olive-green, except the first dorsal, which is gray or lavender; upper half of opercle, ventrals, and anal with a conspicuous blackish blotch in the young.

Described from numerous examples, measuring from 143 to 878 mm., collected at various localities between and including the Snowy River, N.S.W., and the Pine River, Q.

My "Edible Fishes and Crustaceans of New South Wales" being now unattainable, I think it advisable to republish my reasons for rejecting the supposititious species of Castelnau and Macleay, so as to make this article as complete as possible; and at the same time to bring my account of the species up to date by going thoroughly into the claims of *Percalates fluviatilis* to validity. In the work quoted I remark:—

“A few words are necessary here with regard to the forms of the Australian Perch described as new by Castelnau and Macleay, the types of all of which are missing. In 1872 the former created three new species to which he gave the names *Lates similis*, *L. antarcticus*, and *L. victoria*. To these, between the above date and 1881, he added a fourth species, *L. curtus*, from the Richmond River. In 1876, Alleyne and Macleay described, under the name *Pseudolates cavifrons*, a North Australian fish, and in the following year the latter author redescribed the same species as *Lates darwiniensis*; these two names may be at once dismissed from consideration as being mere synonyms of the widely distributed *L. calcarifer*, as an examination of the type specimens at once reveals. Finally in 1881 Macleay described a *Lates ramsayi* from a single specimen taken in a freshwater pool near Parramatta, the type of which is also missing. We have, therefore, in the restricted genus *Percalates*, no less than five spurious species, excluding the original *P. colonorum*, all described from a similar and somewhat limited area, on what appear to be insufficient grounds. That none of the later writers on Australian fishes (Johnston, Catalogue of Tasmanian Fishes, 1882, McCoy, loc. cit., 1878, and Lucas, Census of Victorian Fishes, 1889) except the author (Catalogue of New South Wales Fishes, 1885), venture an opinion on their specific identity or otherwise, is, it must be conceded, a most unsatisfactory state of affairs, and merits, therefore, a more extended inquiry than is usually necessary in such cases.”

To these must now be added *Percalates fluviatilis* Stead, the claims of which have been so strenuously put forward by its author. With this form I shall deal on a future page. Of Steindachner's two species, both from Port Jackson or its immediate neighbourhood, I am unable to say anything from personal knowledge, not being in a position to consult his descriptions or figure, but there can be no doubt as to their identity with one or other of the forms of *P. colonorum*. Of the first, *Dules novemaculeatus*, indeed, McCulloch writes as follows:—“It appears to me that Steindachner's figure of *Dules novemaculeatus* exactly represents the slender form; and, beyond such differences as would be caused by shrinkage due to different methods of preservation (alcohol Steindachner and formalin Stead), it does not differ from Mr. Stead's figure published in the Edible Fishes of New South Wales.”

My original remarks regarding Castelnau's four species are:—

“In *L. similis* the characters relied on for its separation from the type species are absurdly inadequate; these are the shorter snout, which is ‘sensibly less than the diameter of the eye’; with the majority of fishes the comparative size of the eye to the head and to the snout varies with the age of the individual, the young fish having that organ much larger proportionately than the adult. As I have shown above the great variation existing between the comparative measurements of the eye and the snout in twenty five specimens of indubitable *P. colonorum*, ranging from Adelaide to the Richmond River, it is manifest that the stress laid upon this character is altogether misleading, and must be regarded as valueless. The coarser denticulations of the preopercle are also a sign of

immaturity, and as such unreliable. In the large series which has passed through my hands specimens have in rare instances occurred in which the teeth of the lower preopercular limb were directed absolutely downwards; neither this character nor that of the omission of one of the dorsal rays can, therefore, be taken as a valid reason for separating *L. similis* from Günther's well known species."

As regards the length of the snout this is, in Mr. Stead's selected specimen of *P. fluviatilis*, measuring 145 mm., one fourth less than the eye diameter, and even in the 275 mm. example forwarded by the New South Wales Fisheries Department, the two are of equal length, while in the former the preopercular dentition is everywhere exceptionally strong, and in the latter there are but nine soft dorsal rays, so that in these two picked specimens all the characters of *L. similis* are present. It is worth noting that in Castelnau's five descriptions of *Lates* not once does he mention the shape of the head; it is, therefore, presumable that he attached no weight to this character.

Of *Lates antarcticus* Castelnau I wrote:—

"It is unnecessary to go at any length into the question of the validity of *L. antarcticus*, since, with two exceptions, a comparison of Castelnau's description with that given above, will show that no characters are put forward, which are not equally common to *P. colonorum*. These are the increased number of branchiostegal rays, which is stated to be seven in this species as against six, which the examination of numerous specimens has shown to be the normal number in *P. colonorum* as here and elsewhere stated, and also recorded by Prof. McCoy. I do not, however, attach any importance to this seeming discrepancy, since it is possible that the number is merely copied from the generic description of *Lates* given by Günther and which is correct of that genus,² as restricted to the two species *L. niloticus* and *L. calcarifer*. It may be further pointed out that in few, if any, of his descriptions of new genera and species does Castelnau take notice of this important character. The second exception, namely the coloration, is not of sufficient importance to justify the retention of *L. antarcticus* as a distinct form, and this name also must, therefore, sink into a synonym of the typical species. Further on (*see p. 7*) I shall have occasion to refer to a form which, by a casual observer, would be set down as distinct, but which, scientifically examined, is easily seen to be no more than a local variety of the common Australian Perch due to the greatly changed conditions under which it exists. This form may possibly be the *L. antarcticus* of Castelnau, though, if so, it is difficult to say why he should especially designate it the 'Sea Perch.'

"Of *L. victoria* it is needless to say more than that no rational person is likely to believe that the substitution of a four pointed for a single pointed spine on the opercle is of itself sufficient to constitute a species.

"In Castelnau's last form *L. curtus* it is only necessary to point out that no reliance can be placed on the depth of the type specimen as indicative of even

² Brit. Mus. Catal. Fish., i, 1859, p. 67.

a variety. The proportion of depth to length is given by him as 1 to 3.33, but examples from Port Stephens, Shoalhaven, Shellharbor, and Ulladulla, examined by the writer in preparation of this article, ranged between 1 to 2.75 and 1 to 3.5. This character, therefore, having proved invalid, and there being no other on which to rely, it follows that *L. curtus* should be merged in *P. colonorum*."

I find all the alleged differential characters attributed to these three latter species—*L. antarcticus*, *L. victoriæ*, and *L. curtus*—reproduced in one or other of the four examples forwarded to me from New South Wales, thus further proving their worthlessness, if that were necessary.

Nothing now remains but to consider the claims of Macleay's *Lates ramsayi*, and a very cursory glance at the description suffices to show that no mandate to specific recognition can be with justice urged on its behalf. Stress seems to have been laid by its author on the fact of this, to him, unique example having been provided with ten dorsal spines and seven anal rays; variations such as these are, as has been shown above, by no means so uncommon as is generally supposed, though the coincidence of their occurrence in the same individual is no doubt much more rare. In no other character does Macleay's diagnosis differ from that of individual specimens of our common Perch, and it, therefore, with the preceding four, must be relegated to the list of useless synonyms. The fact of its having been taken in a land-locked waterhole³ doubtless had some effect on its external appearance and thus helped to deceive its describer.

"Mention was made above of a variety of the common Perch which differed greatly in outward appearance from the ordinary fish. So far these fishes have only been sent to the Australian Museum from the pools in the Snowy River immediately below the Falls, but without doubt other rivers, both of New South Wales and Victoria, will, now that notice is drawn to the form, be found to have evolved under similar circumstances a similar variety. The differences between it and the common market fish, which present themselves at a casual glance, are the much more elongate habit, the proportionally longer and more powerful fins, and, though this is a much less important characteristic, the brilliant silvery color of this variety. A moment's thought, however, will suggest that these differences, however important they may at first sight appear, are only to be expected in fishes living under conditions, which differ so greatly from those under which the species normally exists; for, being practically forced to inhabit rapidly running waters, subject to sudden, severe, and periodical floods, caused for the most part by the melting of the snow on Kosciusko and the neighboring ranges, it is patent that their changed surroundings and conditions of life would induce a change in the direction indicated.

"To Mr. A. M. N. Rose of Campbelltown I am indebted for the knowledge of this well marked form, that gentleman having forwarded to the Australian Museum at my request two specimens, the first taken at Christmas the second late

³ Not in the Parramatta River as stated by Macleay (6).

in the autumn. Neither of these fishes showed the slightest traces of spawning though, if they breed in the river, it is incredible that the season selected for the deposition of its ova by a fish notoriously fond of warm sheltered spots, should be other than one of the two seasons during which my informant forwarded them. Mr. Rose, however, is of opinion that these fishes do not breed, at least not in the river, and he bases his opinion on the facts, certified to me by him, and through him to me by other residents of the district, that the examples caught vary but little in size, the usual length being from fourteen to eighteen inches, that no young fish have ever been observed, that no matter at what season of the year they are captured no milt or roe has ever been found in the ovaries, that they are always in fine condition, and finally that they infinitely excel the estuary Perch in flavor.

"The obvious inference is that certain individuals having made their way into the Snowy River at its entrance into the ocean gradually work upwards and eventually find themselves in the pool below the Falls, and being unable to proceed, remain there until captured or swept downward by flood to the estuary again; these latter having, since their enforced return into calmer and warmer waters, grown sybaritic and fat, may possibly be Castelnau's 'not very common' *L. antarcticus*, which he describes as 'silvery' and 'very savory.'"

The sterility of those fishes, which remain permanently in the pools below the Falls, would be satisfactorily accounted for by the coldness of the water.

Having now cleared the way I shall proceed to discuss the status of the latest claimant to specific honors, Mr. Stead's *Percolates fluviatilis*.

Stead (4) insists on

(a). "*The far more elongate habit.*"

(3) In the four New South Wales examples on which these remarks are wholly based the extreme variation in the depth of the body to its length is 2.44 to 2.87. This is by no means excessive and shows incontestably on how slender a foundation this character rests. In any case the somewhat more slender habit of the fluviatile form and its rather longer and stronger caudal peduncle may clearly be accounted for by the fish's permanent occupation of swiftly running water, as compared with the more equable ebb and flow of the estuarine tideways which *P. colonorum* mostly affects.

(b). "*The non-excavate character of the upper profile of the head, which in *P. colonorum* is universally concave—often highly so.*"

This contention has been dealt with above (see p. 2). It is interesting, nevertheless, to point out that in Boulenger's description of the species, he, with six specimens before him drawn almost assuredly from estuarine sources, writes "upper profile of head *sometimes* concave." The italics are mine.

(c). "*The relatively greater thickness as compared with the body-length.*"

This is a character of minor importance. The forces contributory to the formation of a more slender type of fish (see "a") are also doubtless at work

here to bring about in other directions a habit of body more suitable to the changed conditions under which it now exists. For instance in swiftly flowing mountain torrents a fish with a cylindrical body would offer much less resistance to the current than would one of a deeper and more compressed form, and complies with the primary law which enacts that every natural object shall develop along the line of least resistance; it is probable that, as in this case, a species, the environment of which had been changed from that of a quiet and comparatively sluggish existence to one of continued and strenuous exertion, should tend to assume a shallower and broader habit as the years roll by.

(d). "*The shorter head.*"

In my four specimens the comparative measurements of the length of the head to that of the body are for *P. fluviatilis* 2.62 to 2.88, for *P. colonorum* 2.55 to 2.67. Since, therefore, they are seen to overlap in so small a series, it is evident that little or no reliance can be placed on this character as evidence of specific differentiation.

(e). "*The much more ctenoid character of certain body-scales in all but older specimens.*"

This claim has also been dealt with above (*see* p. 2).

Stead also pointed out that the two forms differed in their habits, but surely that was inevitable in view of their vastly altered conditions of life, and should carry no weight with it.

The only other differential character mentioned by Stead (5) is set forth in the following terms:—"The tail too is larger and altogether more powerful than that of the Estuary Perch." With this contention I have dealt under (a).

In conclusion I assert emphatically that from this re-examination I see nothing to cause me to change my previously expressed opinion, that all the various forms of this fish should be united under the original name—*colonorum*. There is absolutely no structural character by which *P. fluviatilis* can be separated from the parent stock while on the other hand every conceivable shade of variation exists, uniting the two forms. *P. fluviatilis* is doubtless identical with the fish alluded to by me (*loc. cit.* p. 7) as having been sent to the Australian Museum at my request by Mr. Rose from below the Falls of the Snowy River, and rejected by me as not even worthy of varietal rank.

None of the authors, who have so overloaded this species with useless synonyms, seem to have taken into account that owing to diversity of environment; climatic conditions, due not only to their geographical range, but also to the varied altitude at which they may reside; the character of their native streams, whether sluggish and discolored with a muddy or weedy bottom, or clear and sparkling as it flows over a bed of rock and gravel and sand; the nature of the geographical strata over which the stream flows; the great diversity of the food supply; and many other fortuitous circumstances, much greater latitude of variation should be allowed to fluviatile fishes than to their more equably situated

marine relatives. And the variation is apt to be greatly accentuated when the particular fish under review leads, as in this case, both a fresh-water and a brack-water existence.

Reproduction.—During the late autumn and early winter months the Bass drop gradually down, from the upper reaches of the rivers and the quiet billabongs, where they make their home during the greater part of the year, to the estuaries, and finally to the purer waters of the open bay off the mouths of their home streams. Here they shed their spawn during June, July, and August, the season being proportionally later the further we proceed north. The ova are pelagic, and the fry, such as escape their numerous enemies, quickly work their way up stream to seek the safer sanctuary of still lagoon and billabong.

Uses, etc..—The Royal Commission on the Fisheries of New South Wales (1880) reported of this species—“It is a very delicious fish, but never attains a great size and is perhaps of more value for the sport it affords to the amateur fisherman than as an article of food.” While, in the light of our present-day knowledge, much of this estimate of the Bass’ value is liable to provoke a smile, Tenison Woods, from whose work the above quotation is taken, gives an interesting account of its habits and qualities as a sporting fish as any of his successors—or more so. He writes—“The perch affords good sport to anglers. It loves quiet, shady, and deep holes in the rivers, but when the tide is flowing it may be caught in the stream. It is very voracious. In winter the bait is a small mullet or herring, or better still one of the large grubs that bore into trees. In the early spring months it will take a moth readily, either sunk or on the surface. The artificial salmon fly is also a splendid bait for trolling at this time. When moths are scarce a frog is a good bait at night. It must be fastened so that it can swim or, if dead, must be played upon the water to simulate a swimming frog. No perch can resist that bait at night. In summer grasshoppers, especially that known as the ‘Pereher,’ a red species, are good bait, but the best is a black house-cricket or an earthworm. This is a very attractive bait, and if the perch are in a pool, the lines are no sooner down than the bait is taken. For the rest of the year a prawn is the best bait, that is when crickets cannot be got. The bait should be at least four feet from the float. In landing the fish great care should be used, as the mouth is weak and is easily torn away.” These simple instructions appeal mightily to me, some of them are so deliciously Waltonian in their touch, as for instance “if the perch are in a pool,” etc.

Stead contributes the following information regarding its capture for the markets:—“The Estuary Perch is a familiar object to most people in the States of New South Wales and Victoria at least, as a few are generally to be seen amongst the fish in every fishmonger’s stall. Particularly is this so after heavy freshets in our coastal rivers and during the winter months. After heavy rains have fallen on the watershed of, say, one of our coastal rivers, there is in a short time a superabundance of fresh water, heavily charged with silt and often decayed vegetable matter in the tidal portions of the river; and this has the effect of driving out to the lower and cleaner estuaries or harbour waters, most of

the inhabitants, chief amongst which are the Estuary Perch. As there are then many more fish in a given area than previously, the fisherman is enabled to reap a richer harvest with his meshing-nets and his hauling-nets. The same applies to the winter time, when the fishes come down of their own free will to the open water for the purpose of spawning.”

Roughley tells us that—“The flesh of the Estuary Perch is firm and tasty, qualities which render it a valuable and highly esteemed food amongst those who dwell in the districts watered by coastal streams. In addition to this its capture supplies a means of enjoyment to those far removed from the great variety of fishes to be found in the coastal waters.” He continues it “is rarely seen in the markets during the summer months. When the fish congregate at the mouths of the rivers, usually during June, July, and August, the markets are kept fairly well supplied.”

Mr. H. K. Anderson considers that the Bass is undeniably the premier game fish, whether native or introduced, of the Australian rivers.

Dimensions:—Stead remarks—“Though a weight of 5 lb. is attained by this fish, examples of that size are quite uncommon; the more usual size, as seen in the markets, varying from about 12 oz. to 2 lb.” Tenison Woods mentions one of 7½ lb. With reference to this weight I remarked—“As many persons are sceptical of this weight it may be worth mentioning that the writer has seen a specimen, which had been retrieved at the Hamilton Wall, Brisbane River, after an unsatisfactory encounter with a shark. This fish was weighed in my presence, and turned the scale at 6 lb. 12 oz., notwithstanding that a large lump had been bitten out of its flank as cleanly as if done by a surgeon’s knife.”⁴

Range:—Rivers and estuaries of Southern and Eastern Australia from the Murray River, S.A., to the Pine River, S.Q. Rivers of Northern Tasmania.

PLECTROPLITES Gill.

Plectroplites Gill, Proc. Acad. Nat. Sci. Phila., 1862, p. 236 (*ambiguus*): typonym only; id., *ibid.*, 1863, p. 286; Bleeker, Arch. Néerl. Sci. Nat., xi, 1876, p. 267.

Ctenolates Günther, Proc. Zool. Soc. London, 1871, p. 320 (*macquariensis* = *ambiguus*); Ramsay & Ogilby, Proc. Linn. Soc. N. S. Wales, xii, 1887, p. 133; Boulenger, Catal. Percif. Fish., 1895, p. 133.

Body subovate and compressed. Scales small, adherent, finely ctenoid, the exposed surface concentrically striated, arranged in regular series. Lateral line complete, not continued on the caudal fin, the tubes straight, not extending to the margin of the scale. Head large, with more or less concave upper profile and long pointed snout, partly naked, the mucigerous system strongly developed. Mouth terminal and protractile, with moderate, oblique cleft, the lower jaw projecting; maxillary almost wholly exposed, only the upper edge slipping beneath the preorbital when the mouth is shut, naked; supramaxillary present. Jaws, vomer, and palatines armed with villiform teeth, the premaxillary and mandibular bands interrupted at the symphysis; pterygoids and tongue smooth.

⁴ Ogilby, Commercial Fishes and Fisheries of Queensland, p. 14, footnote 9.

Nostrils subequal and approximate, situated in front of the upper half of the eye, the anterior valvular. Eyes small and superolateral, wholly anteromedian. Preorbital, suborbital, and subopercular bones more or less finely serrulate; preopercle serrated, the teeth of the lower limb antrorsely directed; opercle with two spines, the lower the longer, and a wide naked membranous flap; posttemporal exposed and serrulate. One dorsal fin, with x 10 or 11 rays, the spines strong and pungent, the spinous portion longer than the soft. Caudal rounded, with 17 rays, the upper and lower simple, the others branched. Anal fin short, with iii 7 to 9 rays, the second spine longer and much stronger than the third. Pectoral rounded, with 15 to 17 rays, the middle upper ones the longest. Ventrals inserted below the pectoral-base, close together, with a strong spine and 5 soft rays, the outer of which is produced in a filament. Gill-openings wide; gill-membranes separate, free from the isthmus; branchiostegals seven⁶; pseudobranchia present; gills four, a slit behind the fourth; gill-rakers rather long and stout, in moderate number. Air-bladder present, large and simple. Pharyngeal bones densely armed with minute conical teeth. Stomach cæcal; intestinal canal biconvolute; pyloric appendages in moderate number. Premaxillary processes not extending to the frontals, parietal and supraoccipital bones not extending to between the postfrontal processes; supraoccipital crest strong, not produced on the frontals. Vertebrae 11 + 15 = 26.

A monotypic genus, the single species inhabiting the rivers of the eastern half of Australia northward to about the Tropic of Capricorn. Not found in the cismontane rivers of Victoria and New South Wales southward of the Clarence Watershed.

PLECTROPLITES AMBIGUUS (Richardson).

Datnia ambigua Richardson, Zool. Erebus & Terror, ii, Ichth., pt. 1, 1848, p. 25, pl. xix.

Dules ambiguus Günther, Brit. Mus. Catal. Fish., i, 1859, p. 270; Klunzinger, Sitz. Akad. Wien, lxxx, 1880, i, p. 348.

Ctenolates macquariensis Günther, Proc. Zool. Soc. London, 1871, p. 320, pl. xxxiii.

Dules auratus Castelnau, Proc. Zool. & Acclim. Soc. Vic., i, 1872, p. 55.

Dules flavescens Castelnau, Res. Fish. Austr., 1875, p. 10.

Ctenolates ambiguus Günther, Zool. Challenger, i, 1880, Shore Fish, p. 32; Macleay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 354; Woods, Fish & Fisher. N. S. Wales, 1882, p. 103; McCoy, Prodr. Zool. Vic., dec. ix, 1882, p. 15, pl. lxxxiv; Ogilby, Catal. Fish. N. S. Wales, 1886, p. 11; Lucas, Trans. Roy. Soc. Vic. (2) ii, 1890, p. 18; Ogilby, Edib. Fish. N. S. Wales, 1893, p. 22, pl. v; Boulenger, Catal. Percif. Fish., i, 1895, p. 134; O'Connor, Proc. Roy. Soc. Queensl., xii, 1897, p. 109; Zietz, Trans. Roy. Soc. S. Austr., 1902, p. 265.

Ctenolates flavescens Macleay, *ibid.*, p. 355; Ogilby, Catal. Fish. N. S. Wales, 1886, p. 11.

Plectroplites ambiguus Bleeker, Arch. Néerl. Sci. Nat., xi, 1876, p. 267; Waite, Syn. Fish. N. S. Wales, 1904, p. 26; Stead, Fish. Austr., 1906, p. 97; *id.*, Edib. Fish. N. S. Wales, 1908, p. 55, pl. xxiii; Zietz, *ibid.*, xxxiii, 1909, p. 268; Roughley, Fish. Austr., 1916, p. 67, pl. xvii.

⁶ Boulenger (*loc. cit.*) gives the number of branchiostegal rays as "six or seven." I have at different times examined quite a large number of specimens, and have invariably found seven. This should, therefore, be taken as the normal number.

YELLOWBELLY.

Golden Perch; Murray Perch; Kaakaalain (Murrumbidgee natives); Tarkee (Lower Murray natives); Callop (Professional Fishermen of Victoria, *vide* Anderson).⁶

Type localities:—West Australia (*D. ambigua*).

Macquarie River (*C. macquariensis*).

Riverina (*D. auratus*).

Murray River (*D. flavescens*).

Upper contour of body rising abruptly at the nape and much more arched than that of the ventral, its width at the shoulders 1.63 to 1.88 in its depth, which is 2.6 to 3 in its length and as long as or a little less than the length of the head. Caudal peduncle about four ninths deeper than long, its least depth 7 to 7.75 in the body-length. Head about one fifth deeper than wide, its width 1.67 to 2 in its length, which is 2.55 to 2.67 in that of the body. Diameter of eye 1.5 to 2 in its length of the snout and 6 to 8 in that of the head; depth of suborbital two thirds to one half of the eye-diameter; interorbital region convex, its width 5 to 6 in the length of the head. Maxillary extending to below or a little beyond the middle of the eye, its length 2.75 to 2.86 in that of the head, the width of its distal extremity as much as to two thirds of the eye-diameter. Hinder border of preopercle evenly serrated, the teeth at the angle much enlarged, those of the lower border usually arranged in groups.

Tooth-bands of jaws broadest in front, gradually narrowing to an obtuse point behind; vomerine teeth forming an obtusely triangular patch; palatine bands curved, similar to those of the jaws.

Scales in 77 to 88 series above the lateral line; 12 or 13/1/33 to 37 scales between the first dorsal spine and the ventral ridge. Cheek-scales smaller, about half as large as those of the opercle. Lateral line forming a long curve from the upper edge of the opercle to below the last dorsal ray.

Dorsal fin originating a trifle behind the pectoral-base; fourth spine longest, 2.55 to 3.14 in the length of the head, and a little lower than the soft portion, the base of which is clothed with minute scales, its length 1.6 to 1.9 in that of the spinous portion. Caudal fin 4.5 to 4.88 in the body-length. Anal fin originating below the first dorsal ray and terminating somewhat behind the last ray; second spine very strong, usually a little longer than the third, its length 2.83 to 3.7 in that of the head and 1.25 to 1.4 in that of the second and longest ray. Pectoral fin 1.75 to 1.9 in the length of the head, the fifth and sixth rays the longest, extending to below the sixth dorsal spine. Ventral fin, without the filament, a little shorter than the pectoral; the filament more developed in the young, in which it reaches nearly to the vent, obsolete or nearly so in large examples.

⁶ Anderson writes—“Regarding aboriginal names for this fish I do not know, and believe that most of those names used by the present aborigines are ‘pidgin English’ and quite unreliable; hence I place no value on them.”

Gill-rakers 12 or 13 on the lower branch of the anterior arch, the longest equal to or rather less than the gill-fringes and about one ninth of the length of the head. Pyloric cæca 11.

Upper surface of body varying from bronzy to slaty green, the sides more or less richly golden olive, shading below to deep straw-color or even white. Head above purple or purplish brown, the sides green with violet and orange reflections. Dorsal spines lavender, the connecting membranes yellowish gray dotted with blackish; soft portion tawny yellow, becoming darker towards the margin; caudal fin purplish brown, black-dotted; anal basally golden, the distal third deepening to a violet-brown; pectorals and ventrals golden, uniform or dusky-dotted.⁷

In the Thomson River, and possibly elsewhere, there is a dark color-variety, locally known as the "black yellowbelly," in which the normal coloration is more or less completely obscured by an overlying blackish mantle. This may cover the entire head, body, and fins, or may take the form of numerous small black spots, in some cases generally distributed in others arranged in irregular groups, between which the more typical old gold coloring appears. Structurally no difference can be detected between the two forms. For the opportunity of examining this interesting variety I am indebted to their collector, Miss Josephine Baneroff.

Described from nine specimens, measuring from 225 to 380 mm. Two of these are from the Condamine at Dalby, and were presented to the Museum by Messrs. McNaught and Williams; two are from the Upper Noosa, collected by Mr. J. H. Stevens and myself; and the remaining five are from the Thomson River near Longreach. Of the last three belong to the normal, two to the black, form; all five, however, were taken from the same waterhole.

Variation.—In some respects Boulenger's description differs from mine, and notably in regard to the size of the eye, which according to him is "4.5 (young) to 6 (adult) in length of head," whereas I find it "6 (young) to 8 (adult)" in the same; similarly he gives the width of the distal extremity of the maxillary as 1.5 to 2 in the eye-diameter as compared with the 1 to 1.5 of my measurements. His dorsal spines also are longer than I find them, being 2 to 2.5 in the length of the head as against roughly 2.5 to 3 in mine.

Historical.—The earliest notice of this fine species occurs in the first part of the Ichthyology of the Erebus and Terror, where Sir John Richardson published a description and figure taken from two dried specimens, measuring

⁷ Of the numerous freshly caught examples which I have handled, not one showed the slightest trace of the scarlet markings mentioned by Castelnau (1), and reproduced by Tenison Woods and Roughley in their respective accounts of this fish, while the absence of any reference thereto by McCoy and Stead suggests that their experience coincides with mine. Castelnau's examples were obtained in the Melbourne market, where they were exposed for sale after a railway journey of many miles from their Murray haunts. Consequently I have little doubt that the scarlet patches were merely due to the extravasation of the blood in the affected tissues.

respectively 216 and 356 mm., under the name *Datnia ambigua*, the specific name being suggested by his uncertainty as to which genus, *Datnia* or *Dules*, the fish should more properly be referred. These examples are said to have been collected in "Western Australia" by Sir George Gray, but there is apparently some error as to the alleged locality since, so far as is known at the present day, the species does not occur under natural conditions in any part of the great western State, the rivers of South-Western Queensland being, so far as I can ascertain, the limit of its range in that direction. Fifteen years after the publication of Richardson's description Günther (1) removed the species to the genus *Dules*, giving in the British Museum Catalogue of Fishes a very inadequate account of it, doubtless owing to the fact that he only had the original dried specimens to work on. After an interval of a few years he obtained, through the agency of Mr. Gerard Krefft, a 300 mm. example from the Macquarie River, New South Wales, preserved in liquor, and not at first recognizing its identity with Richardson's fish, proposed for it the new generic and specific names of *Ctenolates macquariensis* which, having in the meanwhile realized its true relationship, he subsequently altered to *Ctenolates ambiguus*, which name remained in general use until towards the close of last century. Gill, however, had previously recognized the necessity of separating the Australian fish from both *Datnia* and *Dules*, and proposed the generic name *Plectroplites* for its reception. This name was rejected by Dr. Boulenger in his account of the serranoid fishes for the good and sufficient reason that at first it appeared as a typonym only, without any indication of the characters upon which it was based. But Boulenger unfortunately overlooked the fact that in the following year Gill published a diagnosis of his genus which, though short, was amply sufficient to establish the validity of the name, so that it is now generally referred to as *Plectroplites ambiguus*. Count Castelnau then took a hand in building up a synonymy for our "yellowbelly," describing it under two new names in the course of three years. In his first essay he calls it the "Murray Golden Perch," and describes it, from large specimens acquired in the Melbourne market, under the name of *Dules auratus*, stating that "it appears to be common in the Murray and other rivers of the Riverina," that it "is much esteemed for the table," and that "it often weighs five and sometimes seven pounds." He notes its similarity to the "*Dules ambiguus* of Richardson and Günther," but considers that the difference of "one ray less in the anal and also less scales on the lateral line" warrants him in separating it from that species. I think, however, that most writers will agree with McCoy that "these differences, which induced Count Castelnau to propose a new specific name, are unimportant." His next attempt, in which he describes a 480 mm. specimen, also from the Murray River, as *Dules flavescens*, is equally futile.

Reproduction.—In 1893 I wrote in regard to this phase of the life history of the Yellowbelly—"These important considerations in the economy of our freshwater fishes will never be properly understood until a competent officer shall be appointed by the Government to report fully on these and all other matters

connected with the fishes and fisheries of our transmontane river systems." Such an officer has since been appointed by the Government of New South Wales, and I am here privileged, through the courtesy of the Under Secretary, Chief Secretary's Department, to record Mr. H. K. Anderson's—the officer in question—observations on the breeding of this fish in the waters under his control. These are of such interest that I deem it advisable to publish Mr. Anderson's remarks *in extenso*:—

"In the spring of 1916 and 1917 I was entrusted with the conduct of experimental hatchery operations in relation to Murray Cod and Golden Perch, and the following information regarding the latter species is based on the data gathered on these occasions.

"In the Murrumbidgee River at an altitude of between 370 and 530 feet above sea level many Golden Perch, usually large fishes from five to ten pounds in weight, spawn during October and November in a flooded river. If the season is late, cold and wet, with snow water coming down stream, spawning is considerably retarded, while abnormally warm weather accelerates it.

"The condition of many of the smaller fishes handled by me leads to the belief that there is an autumnal as well as a vernal spawning, but of this I cannot as yet speak with certainty. Examples of fishes with well developed ovaries are captured by net fishermen throughout the whole year.

"Each spawning female, usually found without female companions, is apparently accompanied by a large number of ripe males. I have never yet netted a ripe female Golden Perch without capturing at the same time, and in the same net, from twenty to fifty ripe males.

"The fishes apparently spawn at the edge of the current near the bank, below a spot where a bend in the river leaves a projecting point with comparatively still eddying water behind it. It is in such places that I have caught all the ripe and most of the nearly ripe females so far examined. As a rule the fish were kept in captivity a few days pending complete ripeness. Many Golden Perch, however, spawn in lagoons and outer channels of the river, where the current is not so strong as in the main stream.

"The fertile eggs are semi-buoyant, practically of the same specific gravity as water, and appear to be left by the fishes quite at the mercy of the current.

"The eggs are probably deposited in batches, 50,000 to 100,000 at a time. I do not think the fish, however ripe, has power to eject all her eggs at once because, when artificially stripping, only a limited number of eggs can be extruded without undue pressure, but I found that, after giving the fish a few minutes rest (rolled in wet bagging to prevent struggling), another batch of eggs can be stripped, and so on until all are extruded.

"A five pounds Golden Perch carries from 750,000 to 1,000,000 eggs.

"The unfertilised eggs when first stripped are of a very pale greyish

yellow tint. They measure thirty seven to the linear inch (about .686 mm. each).

“Two hours after fertilisation, at an average temperature of 65° F., the eggs are perfectly transparent under the microscope, moving about in the jars from the bottom to the surface; when water was allowed to drip into the jars for aëration the eggs circulated in ceaseless movement all over the jars from top to bottom; some, probably the unfertilised eggs, floated.

“At two hours after fertilisation the eggs measured thirteen to the linear inch (about 1.954 mm. each), and three hours after stripping, when absorption of water was complete, they measured eight to the inch (3.175 mm. each).

“The egg, after full absorption of water, becomes slightly ovate and is perfectly transparent, resembling a tiny soap bubble with a glistening oil globule at the top.

“The eggs referred to above were stripped at 4.35 p.m. on 18th October, 1917. The first apparent development was visible at 10.15 a.m. on 19th October. This appeared as a tiny foggy opaque spot at the bottom of the egg.

“At 6 p.m. on the 19th October, the foggy spots in the egg had increased in size to nearly one eighth of its capacity, but had assumed no definite shape. At 8.50 the faint outline of the embryo was discernible. At this stage it is colorless, semitransparent, and occupies the bottom of the egg. At 10.50 the embryo, including the opaque foggy mass round which it was curved, had increased in size to about one fourth of the capacity of the egg.

“On the 20th October at 5 a.m. the embryo had further increased, and the eye-spot was visible without magnification. At 12.10 p.m., under a magnification of about fourteen diameters, movement of the embryo was plainly visible, and the foggy mass above referred to had considerably decreased in size. At 10 p.m. the embryo was clearly visible to the naked eye, apparently attached by the head to the oil-globule, and its wriggling movements were distinctly seen without a magnifying glass. At midnight the embryo was still suspended from the oil-globule struggling vigorously in the egg. At 1 a.m. on the 21st fully 75 per cent. of the eggs in the jars contained living struggling embryos.

“At 3 a.m. on the same day a cyclonic wind-storm capsized the oil-stove used to warm the tent where the jars were kept, which with its contents was destroyed by fire in a few moments. Several jars of eggs were carried outside the burning tent, but as the temperature fell rapidly all were lost. I think it probable that the eggs would have hatched out at about 10 a.m. that morning.

“Although I continued netting until the 16th November, and captured many hundreds of Golden Perch, none in spawning condition were secured. The season was exceptionally late, wet and cold, and I am of opinion that the general spawning would not take place until December.”

Mr. Anderson supplies also the following note:—

“In November, 1916, similar work was performed in almost identical

conditions, and the records obtained were practically the same as above. Eggs collected at 11 a.m. on the 24th hatched out during the afternoon of the 26th. Owing to a sudden rise in temperature that day—minimum 50°, maximum 95°—the water in the hatching shed reached 75°, and all the fry died. The surface of the jars and troughs was covered with oil from the eggs, and a great number of dead fry, about the size of a comma in ordinary newspaper text, were floating at the surface. The shells of the eggs retain their transparency, and quickly dissolve without leaving any sediment or residue.”

It is much to be regretted that Mr. Anderson's two attempts to elucidate the larval development of this fish met with unmerited failure in both cases through causes entirely beyond his control, and it is to be hoped that the very failure will further stimulate him to carry on future experimental work to a successful conclusion.

According to Mr. Glencross Smith the Yellowbelly is full-roed early in September on the Darling Downs.

Uses, etc.:—All authorities concur in their appreciation of the edible qualities of this species. Stead writes—“As an article of food the Golden Perch is very well and favourably known, both in the western areas (of New South Wales) and in the cities of Sydney and Melbourne.” Roughley tells us that—“As an edible fish the Golden Perch ranks second only to the Murray Cod amongst our indigenous fresh-water fishes. Its flesh is firm and tasty and is well suited to the many methods of preparation for the table. It is deservedly popular and finds a ready sale in the markets.” Glencross Smith, while acknowledging its excellence, places it third in rank among our fresh-water food-fishes, considering it inferior to the catfish (*Tandanus tandanus*) and the Murray Cod, while Anderson places above it the Trout Cod (*Oligorus mitchelli*) and the Murray Cod.⁸ However he continues—“I do not desire to dogmatise, as I know several men of wide experience, including Mr. Henry Dawson, late Inland Fisheries Commissioner, who place the Golden Perch the first among our inland fishes.” From the little I know gastronomically of the two species I am inclined to agree with Mr. Dawson.

From the angler's point of view they are held in good repute, being plucky and determined fighters when hooked. Writing of them in this connection Mr. Smith says—“Yellowbellies lurk in weedy patches under the shade of logs and overhanging trees, and dart out upon their food, taking it with a rush, and are more particular about their food than Cod. They prefer frogs, shrimps, yabbies, worms, and the white grub from the River Oak (*Casuarina*); also crickets; but they do not care for fish bait. They are fine sporting fishes and will take a spinning bait, and were at one time very plentiful in all our streams, but are gradually being wiped out; dynamite, nets, and no close season being the

⁸ In Part II of the present volume I hope to deal with the various phases of the genus *Oligorus*.

cause.” He has also remarked that the Yellowbelly is the most short-lived of our fresh-water fishes after its removal from the water, invariably dying within five minutes of its capture.

Anderson remarks—“The food of the Golden Perch consists principally of small fishes, including its own species, yabbies, prawns, and insect larvæ. It prefers live food. The most effective baits for the capture of this fish are small live fishes, yabbies, prawns, and artificial spinners. The Aborigines on the Murray seem to prefer the yabbie. The Golden Perch will not, I think, rise to the surface for an artificial fly, but a salmon fly skilfully worked through the water, particularly if fitted with a spinning head, will tempt them. From the point of view of sport I consider the Golden Perch second among the fishes of the Murray System.”

Stead informs us that “it is pre-eminently what might be called a ‘still-water’ fish, being very abundant in lagoons and billabongs. It is also a ‘mid-water’ fish; that is, it swims at some distance from the bottom usually. It is a fish of the plains rather than one of the mountains.” Further on he says—“Though taken by hook and line, the usual method of capture is by means of a short meshing-net (gill-net) which is set at night across the billabong or lagoon.” And, quotes the evidence of a professional fisherman, as telling him “that one of this species will blunder straight into a meshing-net, apparently without seeing it; while a Murray Cod under the same circumstances would swim up to within a short distance of the net, and then quickly take fright and double back again.”

Dimensions:—In large rivers, such as the Murray and its more important tributaries, the Yellowbelly grows to a considerable size. The largest weighed by Mr. Anderson was a female, taken in Yanco Creek, which turned the scale at 14 lb. 2 oz. This, however, seems to be quite an unusual size, most writers being content to credit it with a maximum weight varying between 7 and 10 lb.; while according to Roughley the average of the fishes sent to the Sydney Market is from 4 to 5 lb. In the Queensland rivers, with their lesser volume of water, it does not as a rule attain to such a size as in more southern streams, nevertheless specimens approximating to the 10 lb. limit are occasionally captured, and I have before me now a photograph, given to me by Mr. Glencross Smith, of an example taken in Oakey Creek, which weighed 9 lb. 12 oz.

Range:—All the rivers of the Murray System; cismontane rivers of Eastern Australia from the Clarence to the Dawson; rivers of South-Western Queensland—Barcoo, Landsborough, Cooper, and Diamantina (*Anderson*); Thomson River, common (*Miss Bancroft*). Dr. T. Bancroft writes—“The Yellowbelly does not occur in the Burnett River, but I caught a few by netting in the Upper Dawson.”

PART XI.—LUTIANIDÆ (No. 2).

LUTIANUS NEMATOPHORUS Bleeker.

(Plate I.)

Mesoprion nematophorus Bleeker, Act. Soc. Sci. Indo-Neerl., viii, 1860, Celebes, p. 56; id., Versl. Akad. Amst., xii, 1861, p. 46.
Lutjanus nematophorus Bleeker, Verh. Akad. Amst., xiii, 1873, Revis. Lutjan., p. 12; id., Atlas Ichth., viii, 1876, p. 47, pl. cclxxxv, fig. 3.

THREADFINNED SEA PERCH.

Type locality:—Celebes.

Body deeply subovate and strongly compressed, the dorsal and ventral contours symmetrical, its width 2.55 in its depth, which is 2.55 in its length to the root of the caudal and one eighth more than the length of the head. Caudal peduncle three eighths longer than deep, its least depth 2.5 in the length of the head. Head two ninths longer than deep, its upper profile behind the snout and that of the nape gently and evenly rounded, its width 2.25 in its length, which is 2.85 in that of the body. Snout long and pointed, with linear moderately acclivous profile, its length 2.33 in that of the head. Eye small, its diameter 2.37 in the length of the snout, 5.44 in that of the head, and 1.5 in its distance from the end of the maxillary groove. Interorbital region convex, its width one eighth more than the eye-diameter and 4.87 in the length of the head. Jaws subequal; maxillary extending to below the anterior border of the eye, its length 2.5 in that of the head, the width of its subtruncate distal extremity 1.3 in the eye-diameter. Preopercle with a slight emargination above the angle, in and beyond which it is feebly serrulate; opercle without spine, the lobe obtusely pointed; post-temporal feebly serrated.

Scales in 57 series above the lateral line, disposed somewhat obliquely to the dorsal profile, in 51 horizontal series below the line; 8/1/22 scales between the first dorsal spine and the ventral ridge. Head naked, except the opercle, subopercle, a patch from seven to nine scales wide on the cheek posteriorly, a triserial postorbital band, and a short biserial temporal band. Lateral line with 54 pore-bearing scales, the tubes branched. Soft dorsal and anal fins each with a well developed scaly sheath, the membranes naked; accessory ventral scale small and blunt, 1.5 in the eye-diameter.

Dorsal fin with x 17 rays, originating above the lower angle of the pectoral-base, the spinous portion one fifth longer than the soft; spines low, slender but pungent, increasing in length to the fifth, beyond which they decrease to the ninth; last spine a little longer than the fifth and 3.44 in the length of the head; fourth to seventh rays produced and filiform, extending to or beyond the extremity of the caudal; beyond these the rays gradually decrease, the last being about equal to the fifth spine. Caudal emarginate, the middle rays 1.5 in the upper lobe, which is 3.67 in the body-length. Anal fin with iii 9 rays, originating below the third dorsal ray; spines short and stout, the third longest, 4.14 in the length of the head; soft portion with acutely pointed outline, the anterior rays produced, the fourth the longest, extending beyond the base of the caudal, length



LUTJANUS NEMATOPHORUS Bleeker.

Phyllis Clarke, del.

of soft portion 2.37 in its height, 1.75 in that of the dorsal fin, and 2.55 in that of the head. Pectoral with 16 rays, its length 1.22 in that of the head; fifth ray longest, extending to below the first dorsal ray. Ventral inserted below the end of the pectoral-base; spine rather weak but much longer than the longest dorsal spine, 1.75 in the outer rays, which are subequal, 1.13 in the length of the pectoral, and reach almost to the vent.

Gill-rakers short and stout, 10 on the lower branch of the anterior arch, the longest 1.8 in the eye-diameter.

Roseate, the lower surfaces lighter and obscurely tinged with yellow; body with ten narrow, more or less wavy, longitudinal blue bands; the upper pair meet across the nape; the second pair extend upon the occiput, where they are broken up into irregular spots; the third reaches to above the post-temporal, beyond which it is similarly broken up; the fourth is continued forward to the eye and, though less clearly, along the upper eyelid and across the nostrils, meeting near the end of the snout; the fifth ceases at the opercle; these five pairs terminate at various points along the base of the dorsal fin; the sixth reaches to the eye and is continued on the snout as a series of small blue spots, which meet across the tip of the snout; the seventh extends to the opercle; the eighth to the middle of the preorbital; the two lower to the pectoral, in front of which are some irregular spots and bars; a narrow blue cross-bar between the eyes. All the fins pinkish, the caudal with a narrow dark terminal band.

Described from a fine specimen, 353 mm. long, trawled in Hervey Bay, and presented to the Queensland Museum by the Department of Fisheries through Captain Hoult of the "Bar-*ea-Mul*."

The species was only known previously from two young examples, measuring 82 and 86 mm., recorded by Bleeker from Singapore and Celebes. Its rediscovery on the South Queensland coast is, therefore, of more than ordinary interest.

PART XVI.—OPISTHOGNATHIDÆ (No. 1).

Opisthognathidæ Jordan & Evermann, Fish. North & Mid. America, pt. 3, 1898, p. 2279; Regan, Ann. & Mag. Nat. Hist. (8) xii, July 1913, p. 138.

THE JAWFISHES OR SMILERS.

Body elliptical to elongate, moderately compressed, more or less completely covered with small, cycloid scales. Lateral line single, incomplete, running close to and parallel with the dorsal contour, ceasing below the anterior dorsal rays. Head large and naked, with strongly curved anterior profile, its upper surface smooth. Mouth terminal, horizontal or nearly so, protractile, the cleft usually very wide; jaws normally formed; maxillary broad and exposed, with supplemental bone. Jaws with bands of villiform or cardiform teeth; vomer usually with a few teeth; palatines and tongue toothless. Two nostrils on each side. Eyes very large, lateral, anterior. Opercles unarmed. Dorsal fin continuous, the spinous and soft portions of nearly equal length, the spines slender and flexible,

passing gradually into soft rays. Caudal rounded or lanceolate, with 14 or 15 principal rays, the outer ray above and below simple. Anal fin long and low, with two weak spines. Pectorals short and fan-shaped. Ventrals inserted in advance of the pectorals, close together, each of a spine and five rays, and without accessory scale. Gill-openings wide; gill-membranes partially united, free from the isthmus; six branchiostegals; pseudobranchiæ present; gills four, a slit behind the fourth; gill-rakers long and slender. Air-bladder present, small. No pyloric cæca. A narrow subocular shelf. Skull narrow between and expanded behind the orbits; postorbital part evenly convex above; occipital crest only on the posterior face of the skull, which is long and oblique; no parietal crest; exoccipital condyles separate; prootics forming a roof for the myodome; basi-sphenoid present. Foramen in hypercoracoid; radials rather broad and flat, two on the hypercoracoid and two on the hypocoracoid. Vertebrae 29 (10 × 19)⁹; precaudals with parapophyses from the fifth; three ribs sessile, five on parapophyses; epipleurals on ribs.

The *Opisthognathida*, though weak in point of numbers, forms a most interesting family of trachiniform percoids; it consists of fishes of small or moderate size, inhabiting rocky and coralline bottoms within the tropical and temperate zones. Its distribution is peculiar, no species having so far been recorded from the Mediterranean nor the Eastern Atlantic, nor from any of the Pacific Islands, nor the West Coast of the Americas, except the Gulf of California, where an isolated colony, comprised of five species, exists. The extreme limits of their polar range lie between lat. 40° N., where *Gnathypops hopkinsi* has been taken off Misaki, Japan, and lat. 34° S., where *Merogymnus jacksoniensis* is found. These fishes are everywhere of rare occurrence, many of the species being only known from the single example described. The "Smilers," to give them the local vernacular name bestowed upon them, so a friend tells me, "because of their fine open countenance," are essentially carnivorous and rock-loving fishes, delighting in boulder-strewn shoals and coral reefs at a moderate depth. Hence we find that in America as here many of the species are only known from off-shore snapper grounds and similar localities, where they are occasionally taken by hand-line in company with more valuable fishes or even from the latter when captured disgorging them. The species vary greatly in coloration, some of them, such as my *Merogymnus eximius*, being arrayed in a livery of most gorgeous splendor, while others, as my *Gnathypops inornata*, are soberly clad in uniform brown. One of our species, *G. maculata*, is said by the pearl-fishers to scoop holes in the sand among the sea-fan forests of our tropic seas, from which it sallies forth to pounce upon a passing prey, returning again to its lair after each excursion. Regarding this habit Mr. W. H. Longley, from personal observation when "equipped with a diving hood in the unknown world of coral labyrinths at the bottom of the sea," gives some interesting information, which may advantageously be reproduced here.¹⁰ He writes:—" *Gnathypops aurifrons* prepares

⁹ Vertebrae 27 to 34, *vide* Jordan & Evermann, *ut supra*.

¹⁰ American Museum Journal, xviii, February 1918, p. 81.

its own shelter in sandy places where the substratum is sufficiently compact to make successful tunneling possible. Jaws and gaping mouth are its only entrenching tools, but meet its every need. It is found not uncommonly upon the open reef in little colonies, the formation of which is probably due in part to the discontinuous occurrence of suitable bottom rather than to the social instincts of the fishes themselves. During the day, if undisturbed, *Gnathypops* may be regularly observed resting nearly motionless in a semivertical position above its burrow. When alarmed it retreats into its hole tail foremost and conceals itself until the disturbance outside has ceased. Then it reappears cautiously, its beady black eyes being so situated that it is able to sweep the horizon with minimum exposure. If nothing happens to renew its alarm, it mounts a little farther until its ventral fins are free, rests for a moment in the mouth of its burrow, and finally rises easily and gracefully to its original position. Still another of these fishes (as yet unidentified) shows a different variation of the tubiculous instinct. It lives in holes, quite possibly worm-tubes, which it discovers ready formed in pieces of dead coral upon the bottom. Its most striking structural feature is the immense dorsal fin, which when raised seems nearly as high as the fish is long. Its most interesting habit is that of protruding its body for about half its length from the chamber it occupies, and then elevating and depressing its great fin rapidly as if it were wigwagging in piscine code. This impression is heightened when two individuals separated by no great distance stand erect and repeat the performance in alternation." Nothing is known as to the breeding habits of these fishes, nor have I ever seen an example with ripe spawn, though all those which I have handled were fully adult. That the young are never found along the foreshores nor in the débris of the seine net seems to demonstrate the demersal character of the ova. No data are available as to their edible qualities, unless it be that of an acquaintance, who took one home and had it fried; he told me it was "as good as any other rockfish." On account of their scarcity and the difficulty of obtaining them all the species are greatly in request for museum collections, and every example should, therefore, be carefully preserved and forwarded, with as little delay as possible, to the nearest scientific institution. Six genera and thirty species are now recognized. As mentioned by Waite it has been suggested in some quarters that *Gnathypops* may merely be the female of *Opisthognathus*, but the fact that the latter genus is quite unknown in Australian waters sufficiently contravenes any such theory.

Appended is a key to the opisthognathoid genera. Those which are printed in italics have not so far been found in Australian seas, but, with the exception of the West Indian *Lonchopisthus* there is no insuperable reason why the other genera should not occur here.

*a*¹. Maxillary about as long as the head, produced behind in a flexible lamina i. *Opisthognathus*.¹¹

*a*². Maxillary much shorter than the head, but extending well beyond the eye, its distal extremity truncate.

¹¹ Cuvier & Valenciennes, Hist. Nat. Poiss., xi, 1836, p. 498. Type *O. sonneratii* = *O. nigromarginatus* Rüppell.

<i>b</i> ¹ . Caudal fin rounded.	
<i>c</i> ¹ . Trunk anteriorly naked	ii. <i>Merogymnus</i> .
<i>c</i> ² . Trunk everywhere scaly.	
<i>d</i> ¹ . Dorsal spines all simple	iii. <i>Gnathypops</i> .
<i>d</i> ² . Anterior dorsal spines transversely forked	iv. <i>Stalix</i> . ¹²
<i>b</i> ² . Caudal lanceolate	v. <i>Lonchopisthus</i> . ¹³
<i>a</i> ³ . Maxillary not extending beyond the eye	vi. <i>Owstonia</i> . ¹⁴

i. MEROGYMNUS Ogilby.

Merogymnus Ogilby, Proc. Roy. Soc. Queensl., xxi, 1908, p. 18 (*eximius*); McCulloch, Rec. West Austr. Mus., i, 1914, p. 216.

Body elliptical or elongate-elliptical, the greater part of the trunk naked. Maxillary much shorter than the head, its distal extremity much dilated. Jaws with bands of villiform teeth, the outer row scarcely larger than the others. Caudal fin rounded. Gill-rakers in rather large number, long, and slender.

Eastern and South-Eastern Coasts of Australia. Two species.

<i>a</i> ¹ . Scales very small, covering about half of the sides and belly	1. <i>eximius</i> .
<i>a</i> ² . Scales larger, but narrowly entering the trunk; belly naked	2. <i>jacksoniensis</i> .

1. MEROGYMNUS EXIMIUS (Ogilby).

(Plate II.)

Merogymnus eximius Ogilby, Proc. Roy. Soc. Queensl., xxi, 1908, p. 18.

HARLEQUIN SMILER.

Type locality:—Snapper Banks off Moreton Bay, S.Q.

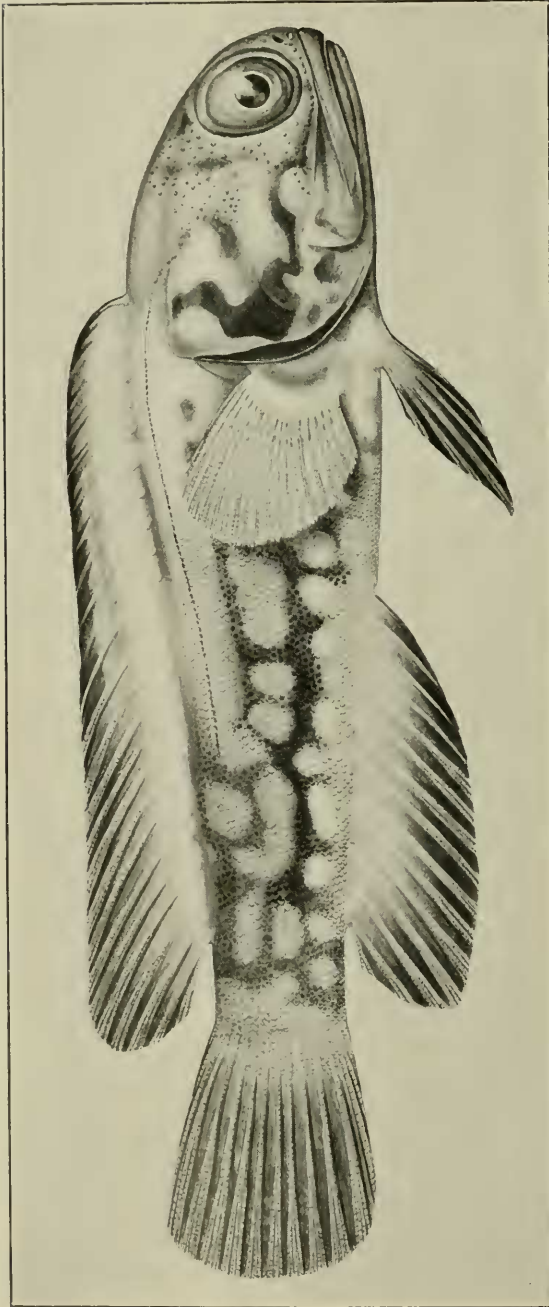
Body elliptical; its width at the shoulder 1.7 to 1.83 in its depth, which is 3.62 to 3.75 in its length and 1.25 to 1.33 in the length of the head. Caudal peduncle four fifths deeper than long, its least depth 2.55 to 2.7 in the length of the head. Head a little deeper than wide, the fronto-occipital profile evenly rounded, its width 1.4 to 1.5 in its length, which is 2.83 to 2.9 in that of the body. Snout short, with linear or gently rounded, vertical profile, its length 1.75 to 1.8 in the eye-diameter, which is 2.83 to 3.2 in the length of the head. Interorbital region narrow and feebly concave, its width 3.43 to 3.75 in the eye-diameter. Maxillary extending to about one diameter of the eye behind the eye, its length 1.4 to 1.5 in that of the head, the width of its distal extremity about two ninths of its length.

Scales extending forwards on the trunk to below the middle of the

¹² Jordan & Snyder, Proc. U. S. Nat. Mus., xxiv, 1902, p. 495. Type *S. histrio* from the Japanese coast.

¹³ Gill, Proc. Acad. Nat. Sci. Phila., 1862, p. 241. Type *L. micrognathus* from Cuban waters.

¹⁴ Tanaka, Journ. Coll. Sci. Tokyo, xxiii, 1908, p. 47. Type *O. totomiensis* from the seas of Japan.



MEROGYMNUS EXIMIUS Ogilby.

Phyllis Clarke, del.

appressed pectoral, anteriorly distant and deeply imbedded, becoming more crowded and finally imbricate on the tail; belly scaly. Lateral line composed of about 80 short tubes, terminating below the 5th or 6th dorsal ray.

Dorsal fin with xi 13 rays, originating above the tip of the maxillary; outer border of the fin linear, the spines and rays gradually increasing in length to the 9th to 11th rays, which are 1.63 to 1.75 in the length of the head. Caudal fin long, 3.9 to 4.3 in the body-length. Anal with i 12 or 13 rays, originating below the 1st dorsal ray, its longest ray 1.7 to 1.83 in the length of the head. Pectoral rounded, with 19 rays, the middle the longest, 1.88 to 2 in the head. Ventral produced, about one third longer than the pectoral, the 2nd and 3rd rays subequal, reaching to or nearly to the vent.

Gill-rakers long and slender, with the inner edge feebly spinulose, 16 + 26 on the anterior arch, the longest 2.16 in the eye-diameter.

Golden or golden brown above; sides with two series of large, round or oval, golden spots, separated by broad blue interlacing bands; abdominal region and extremity of tail violet, with splashes of greenish gold. Head lilaceous, with irregular violet spots and bars; a deep blue blotch, prolonged upwards as an uneven band on the opercle; branchiostegal region blackish. Outer half of spinous dorsal dark olive-green, narrowly bordered above with purple, below with pale blue; the lower band is continued to the end of the soft dorsal, the outer half of which is pale olive-green, with part of the membrane blue, as also is the base. Anal blue, with a median and a basal series of golden spots. Caudal rays olive-green or purple, the interradiial membrane blue. Pectoral pale yellowish brown, the base with one or two vertical blue bars. Ventral bluish black.

Described from five specimens, 224 to 305 mm. in total length, in the collections of the Queensland Museum and the Amateur Fishermen's Association. These were taken on the Snapper Grounds off Moreton Bay, where it does not appear to be uncommon, and which is still the only recorded habitat of the species. It is said to be good eating.

Our illustration is taken from a Queensland Museum example. Reg. No. I. 17/2840.

2. *MEROGYMNUS JACKSONIENSIS* (Macleay).

Opisthognathus jacksoniensis Macleay, Proc. Linn. Soc. N. S. Wales, v, 1881, p. 570; O'Connor, Proc. Roy. Soc. Queensl., iv, 1888, p. 43.

Gnathypops jacksoniensis Waite, Rec. Austr. Mus., v, 1904, p. 240, pl. xxvi, fig. 2.

Merogymnus jacksoniensis McCulloch, Rec. West Austr. Mus.,

SOUTHERN SMILER.

Type locality:—Port Jackson, N.S.W.

Body elongate-elliptical, its width at the shoulder 1.6 to 1.75 in its depth, which is 4.33 to 4.5 in its length and 1.4 to 1.55 in the length of the head. Caudal peduncle three fourths deeper than long, its least depth 3.44 to 3.6 in the length of the head. Head a little deeper than wide, the fronto-occipital profile

linear or gently rounded and moderately acclivous, its width 1.5 to 1.67 in its length, which is 3.12 to 3.33 in that of the body. Snout short, with feebly rounded subvertical profile, its length 1.5 to 1.63 in the eye-diameter, which is 3.25 to 3.5 in the length of the head. Interorbital region narrow and concave, its width 3.33 to 3.6 in the eye-diameter. Maxillary extending to about one diameter of the eye behind the eye, its length 1.6 to 1.67 in that of the head, the width of its distal extremity 3.16 to 3.5 in its length.

Scales extending forwards along the middle of the trunk to above the vent only, the naked area extending backwards above and below in a gradually contracting band to about the last third of the vertical fins; only those scales on or near the caudal peduncle truly imbricate; belly naked. Lateral line terminating below the 12th or 13th dorsal ray.

Dorsal fin with x 17 rays, originating well behind the tip of the maxillary; outer border of spinous dorsal rounded in front, linear behind, the spines gradually increasing in length to the last, but much lower than the soft rays, the 12th or 13th of which is the longest, 2 to 2.33 in the length of the head. Caudal fin short, 5.16 to 5.67 in the body-length. Anal with i 16 rays, originating below the 2nd or 3rd dorsal ray, the longest ray corresponding to and as long as those of the dorsal. Pectoral rounded, with 20 rays, its length 1.83 to 2 in that of the head. Ventral as long as or a little longer than the pectoral, the 2nd ray somewhat produced, but not nearly reaching to the vent.

Gill-rakers long and moderately slender, with the inner edge spinulose, $9 + 19$ or 20 on the anterior arch, the longest 2.1 in the eye-diameter.

Ground-color varying from rich light brown to lemon yellow, the upper surface and sides of the trunk broadly reticulated with chocolate brown, a wavy median band, which is sometimes black, being always present; throat, breast, and belly immaculate; tail with a few irregular brown spots and wavy lines, each scale with a brown central dot. Upper surface and sides of head profusely dotted and pencilled with brown; inner posterior edges of maxillary and mandible black; distal extremity of maxillary and a broad stripe on the mandible white. Dorsal fin dark purplish brown, with a basal series of lighter spots; soft portion with an additional submarginal row of similar spots and two oblique bands posteriorly. Anal rich brown, with a light basal band. Caudal with three transverse rows of light spots. Pectoral pale yellow, profusely powdered with brown. Outer portion of ventrals purplish black.

Described from four specimens, 212 to 264 mm. in total length, in the collection of the Queensland Museum; they were taken by hook on the Snapper Grounds off Moreton Bay, where, however, it appears to be scarce.

Originally described from Port Jackson in 1881, its range was extended, eight years later, to the Queensland Coast, through a specimen obtained in Moreton Bay by the late Mr. D. O'Connor; these two localities still form the extreme limits of its recorded distribution.